TOWARDS A GREEN ECONOMY – ENVIRONMENTAL IMPACT ASSESSMENT OF LOW INDIRECT LAND USE CHANGE (ILUC) INDUSTRIAL CROPS TO BIOENERGY, BIOFUELS AND BIOPRODUCTS

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European Green Deal

- **Striving to be the first climate-neutral continent**

  - ✓ **No net emissions of greenhouse gases by 2050**
  - ✓ **Economic growth is decoupled from resource use**

⇨ ***development of commercially viable "green products" based on natural resources (e.g. biomass)***

⇨ ***directed to a wide range of applications(e.g. energy/biomaterials)***

⇨ ***increased importance!!!!***

Context….

- ✓ Dedicated crops:
  - ✓ biomass characteristics
    - ✓products and materials of fossil origin replacement
    - ✓e.g. Bioenergy, biofuels, biobased products
  - ✓offers environmental advantages
    - ✓reduction of greenhouse gases
  - ✓social benefits, especially in rural areas
  - ✓ *But….*

But....

- ✓ Increased demand for biomass:
  - ✓ increased competition for land!!!!!!!
    - ⇨ Growth of dedicated biomass crops in marginal soils
      - ⇨ limit the ethical issues associated with competition with food crops

MIDAS Project

✓ to develop, evaluate and optimize sustainable low-ILUC feedstock

⇨ developing selected industrial crops and cropping systems




⇨ *on European marginal agricultural land*

⇨ *in a climate-resilient and biodiversity-friendly way*

⇨ *to support feasible bio-based value chains*

Aim of the study

⇨to identify

⇨ local and site-specific environmental impacts

⇨ associated with the cultivation of these crops in marginal soils

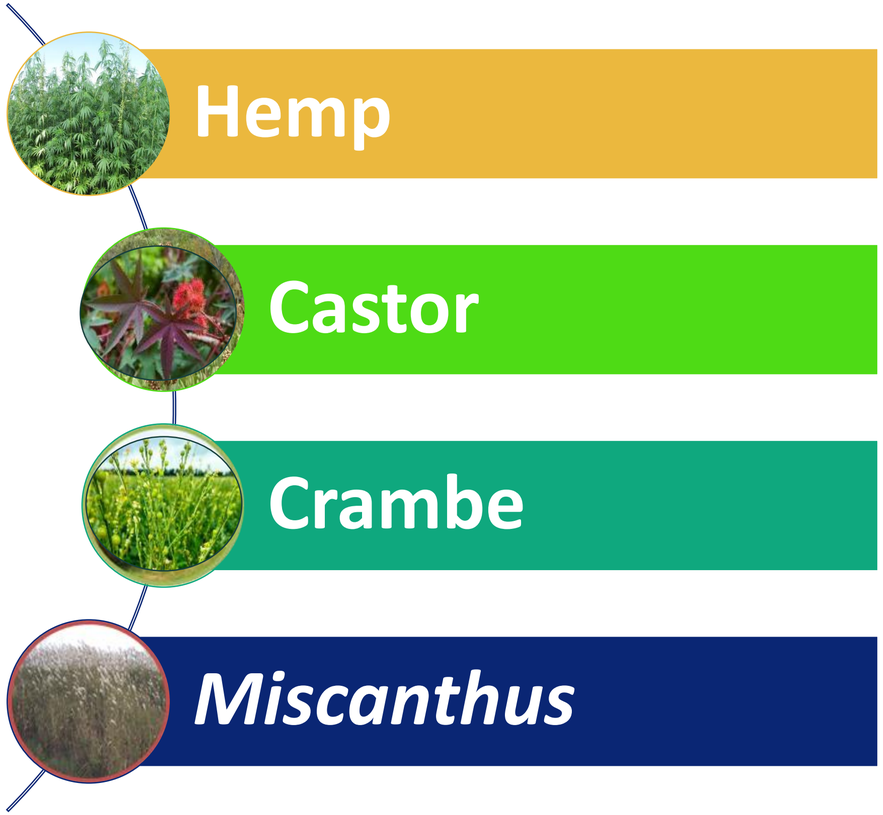
⇨categories studied:

⇨ fertilizers and pesticides related emissions

⇨ impact on soil and water resources

⇨ biological and landscape diversity

Yields… can be affected …



- ↓Non-renewable energy savings
- ↓GHG emissions savings
- Chemical composition
  - increment of [N, P, K, etc] in the biomass
  - the plants may not reach a mature status
- ↑ land use to obtain the same energy output
- ↑ need for fertilizers per unit land
- ↓ shelter for animals
- ↑ energy production costs
- ↑ GHG emissions reduction costs

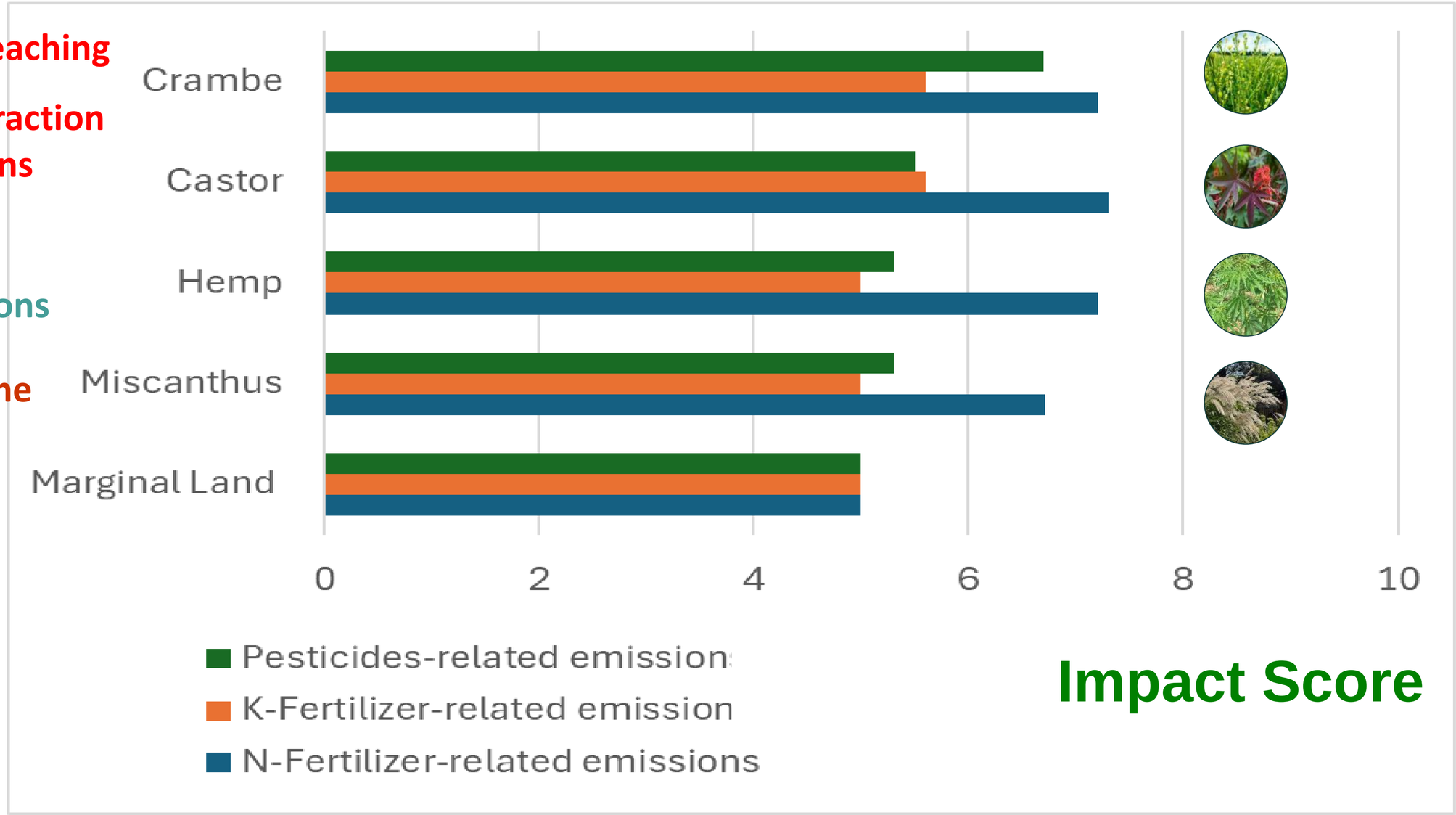
Fertilizer and Pesticides related emissions

- Volatilization of ammonia (NH_3) and oxides of N (NO_x) to the air; contribution to acidification, GHG emissions
- Leaching and runoff of ammonium (NH_4) and nitrate (NO_3) to ground and surface waters; contribution to eutrophication and excess of nitrate in drinking water could be a threat to human health
- Denitrification to nitrous oxide (N_2O); contribution to the greenhouse effect and to ozone depletion
- K emissions – terrestrial euthophication
- Pesticides – pollution of of soil, water, health issues

Fertilizer and Pesticides related emissions

← Advantages Disadvantages →

- ❖ Run-off and leaching
  - ➢ important fraction on N emissions
- ⇨ Annual crops
  - ⇨ ↑ N emissions
- ❖ Root/rhyzome dynamics- perennials
  - ⇨Not accounted



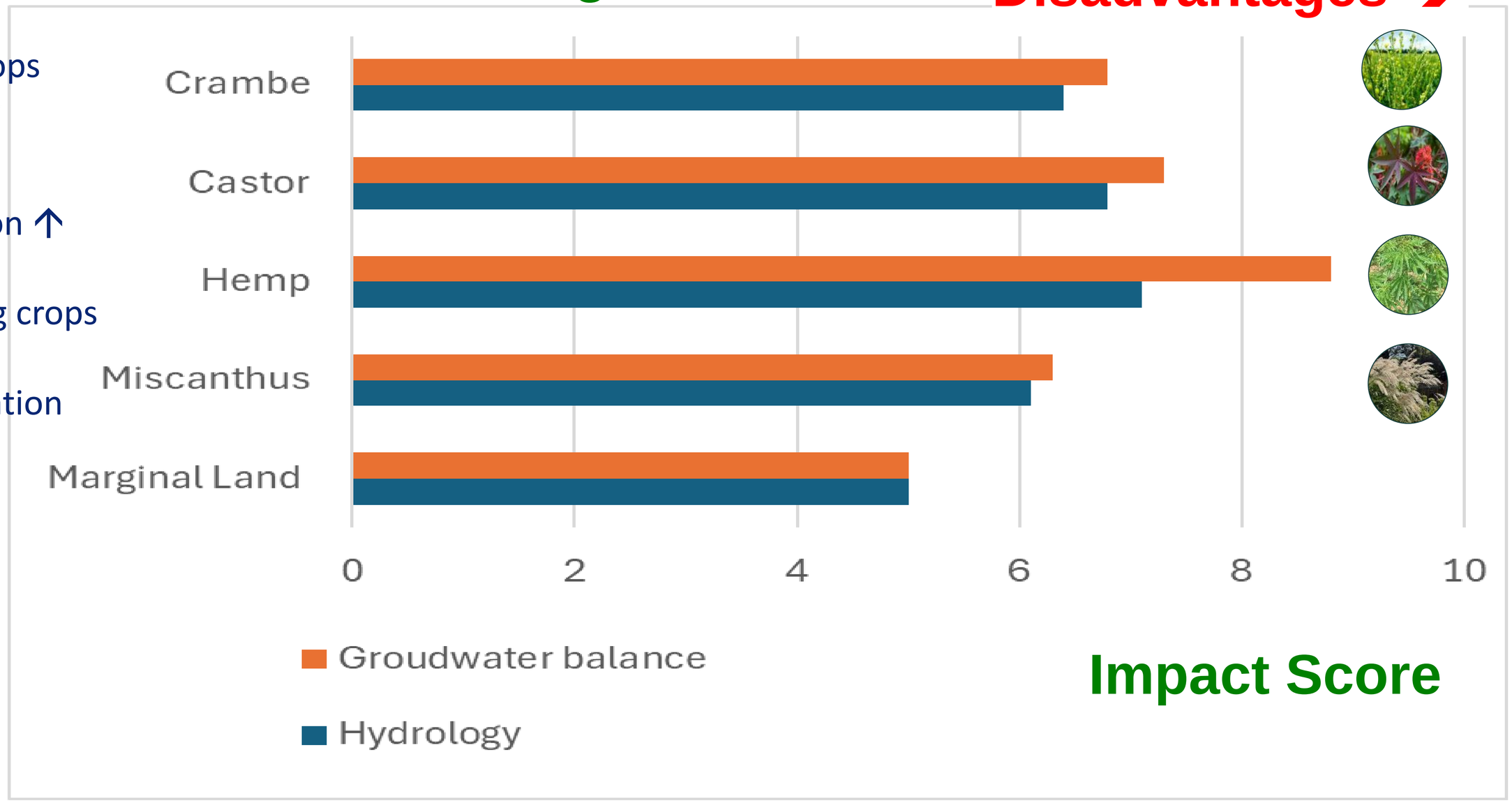
Use of water resources

← Advantages

Disadvantages →

⇨Most crops sufficed by rainfall

⇨Allocation ↑ water-demanding crops to regions ↑precipitation



Use of water resources- Hydrology

⇨ soil cover minimizes run-off

⇨Benefiting perennials

⇨Negative aspect: aquifer refilling slows down

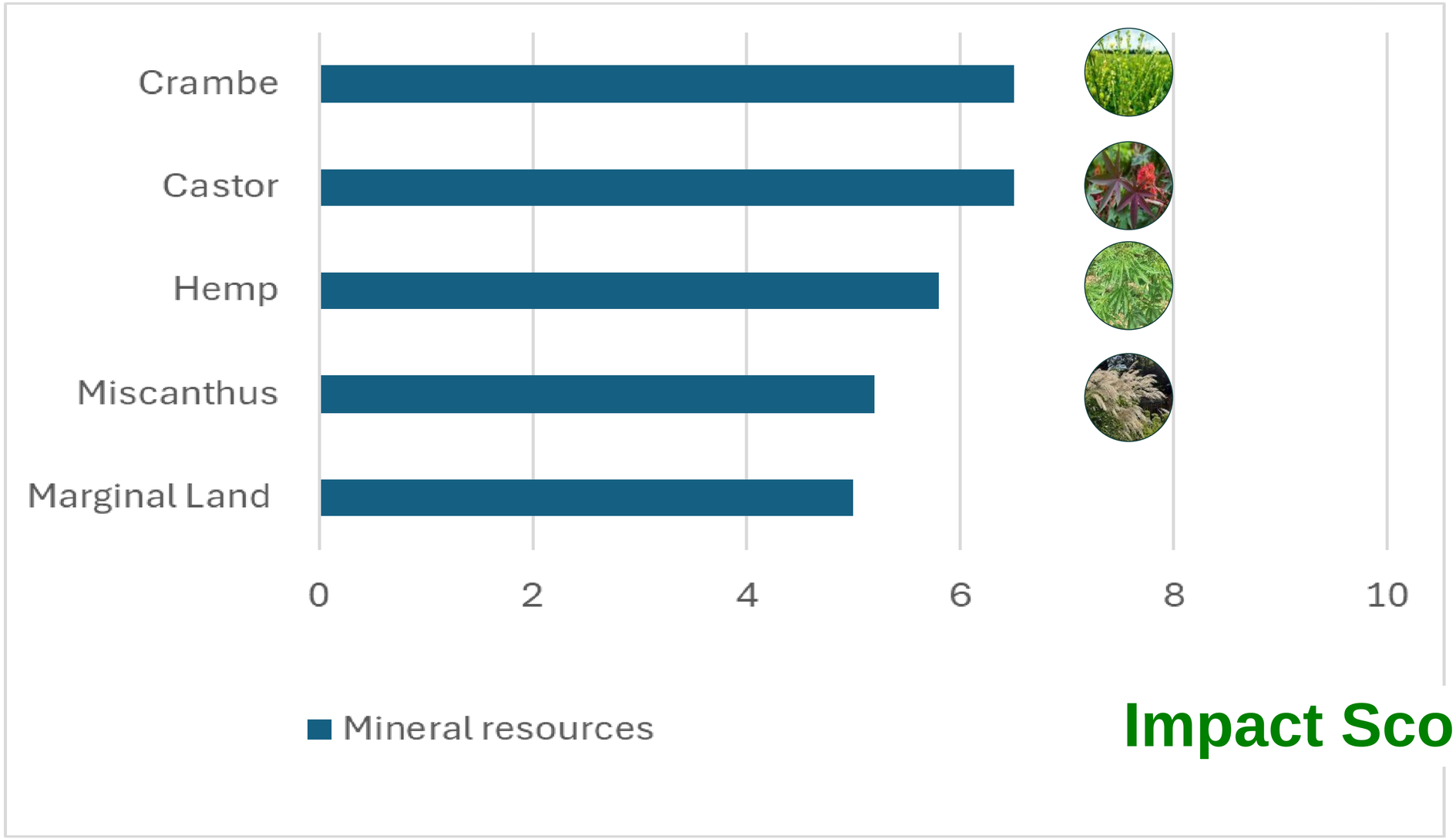
⇨ Deeper roots

⇨High water needs ----annual crops

Impact on mineral resources

← Advantages

Disadvantages →



Impact Score

Impact on soil

⇨ *Erosion:*

⇨potential damage caused by rainfall

⇨Dependence on site

crossed with

⇨soil cover characteristics of the crops

⇨during their cultivation cycles

⇨ Dependence on crop

⇨ each region erosion control actions

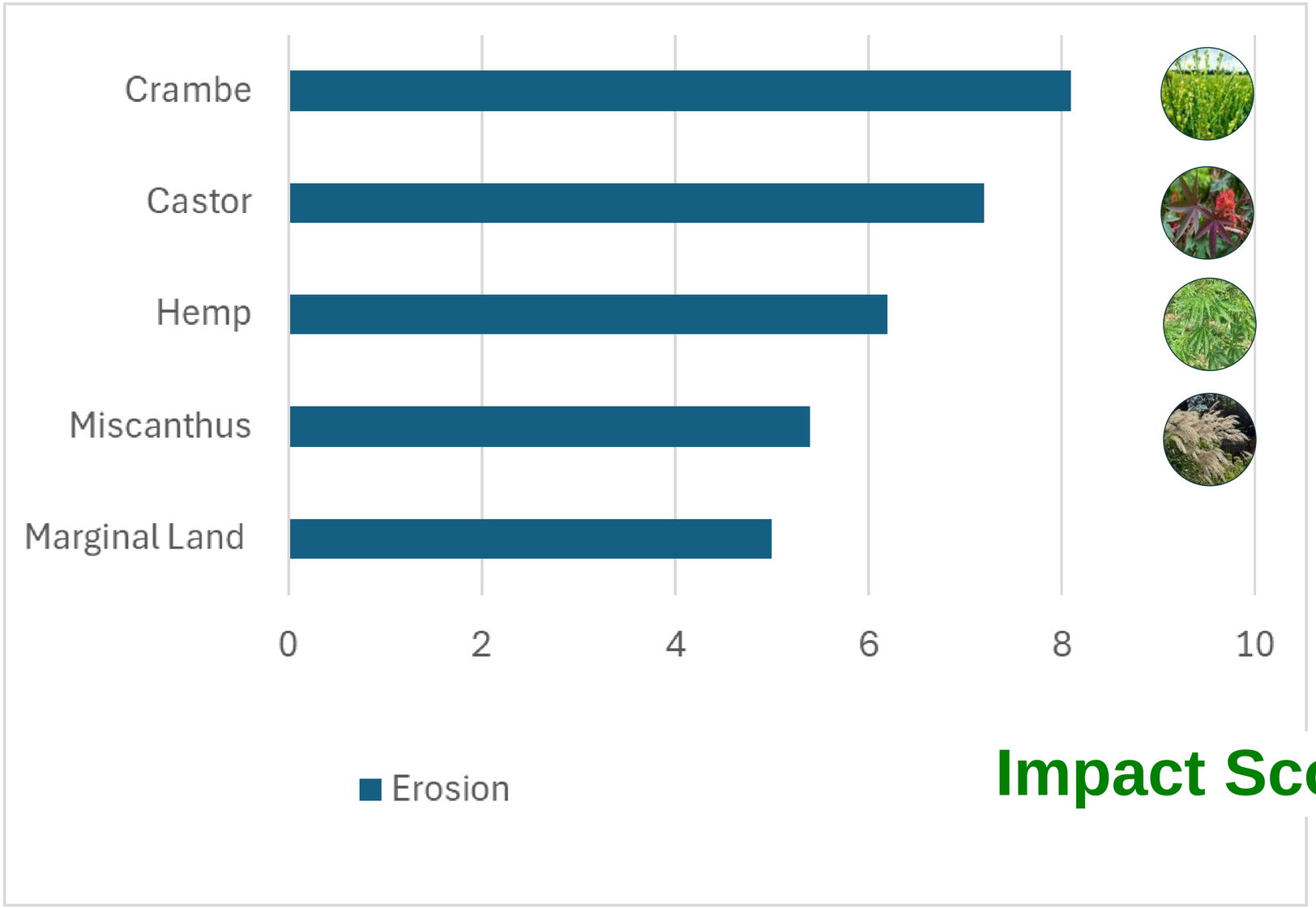
Impact on soil - erosion

⇦ Advantages **Disadvantages ⇨**

⇨ perennials lower erosion risk

↑rainfall interception, ↑ surface cover, longer time

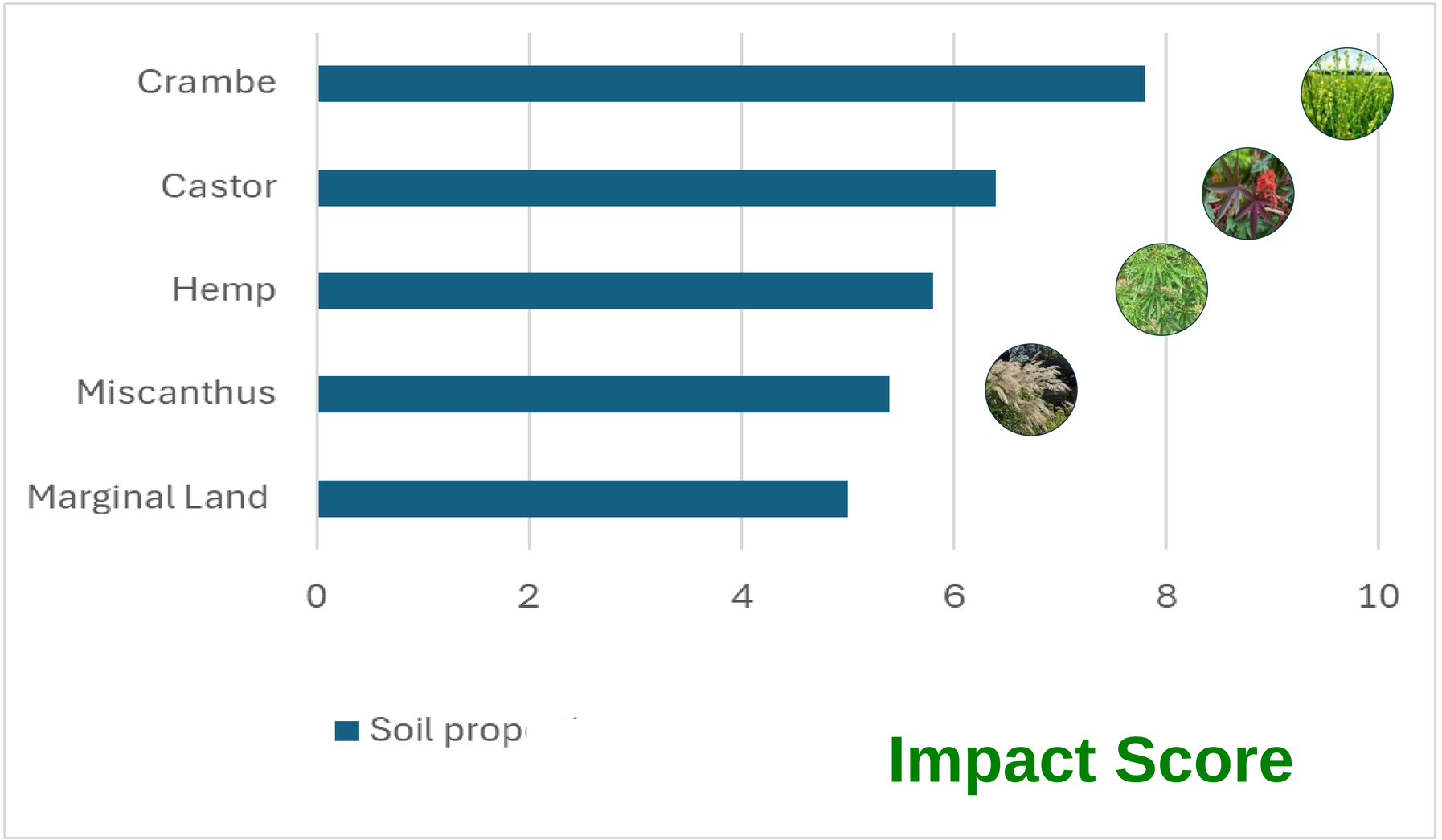
⇨Annuals Higher erosion risk



Impact Score

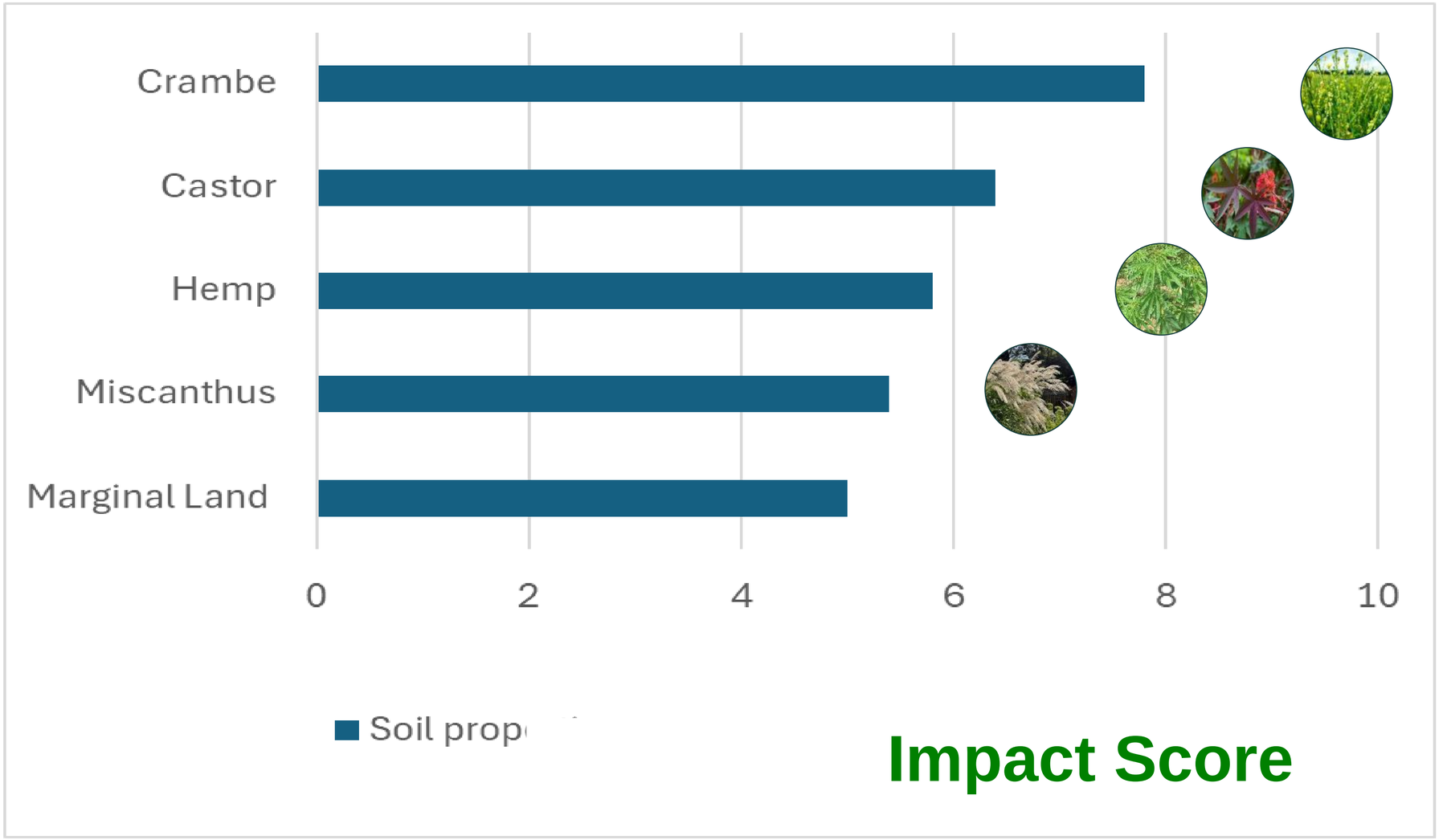
Impact on soil – soil properties

- ⇨ higher SOM
- ⇨ Better structure
- ⇨ pH not affected
- ⇨ Permanence in the soil, inputs of residues, root development, soil amendment not so intensive



Impact on soil – soil properties

- ⇨ annuals
- ⇨ most damaging
- ⇨ high soil revolving, short permanence, litter removal, high soil amendment
- ⇨Lower impact
- ⇨deep roots/litter left

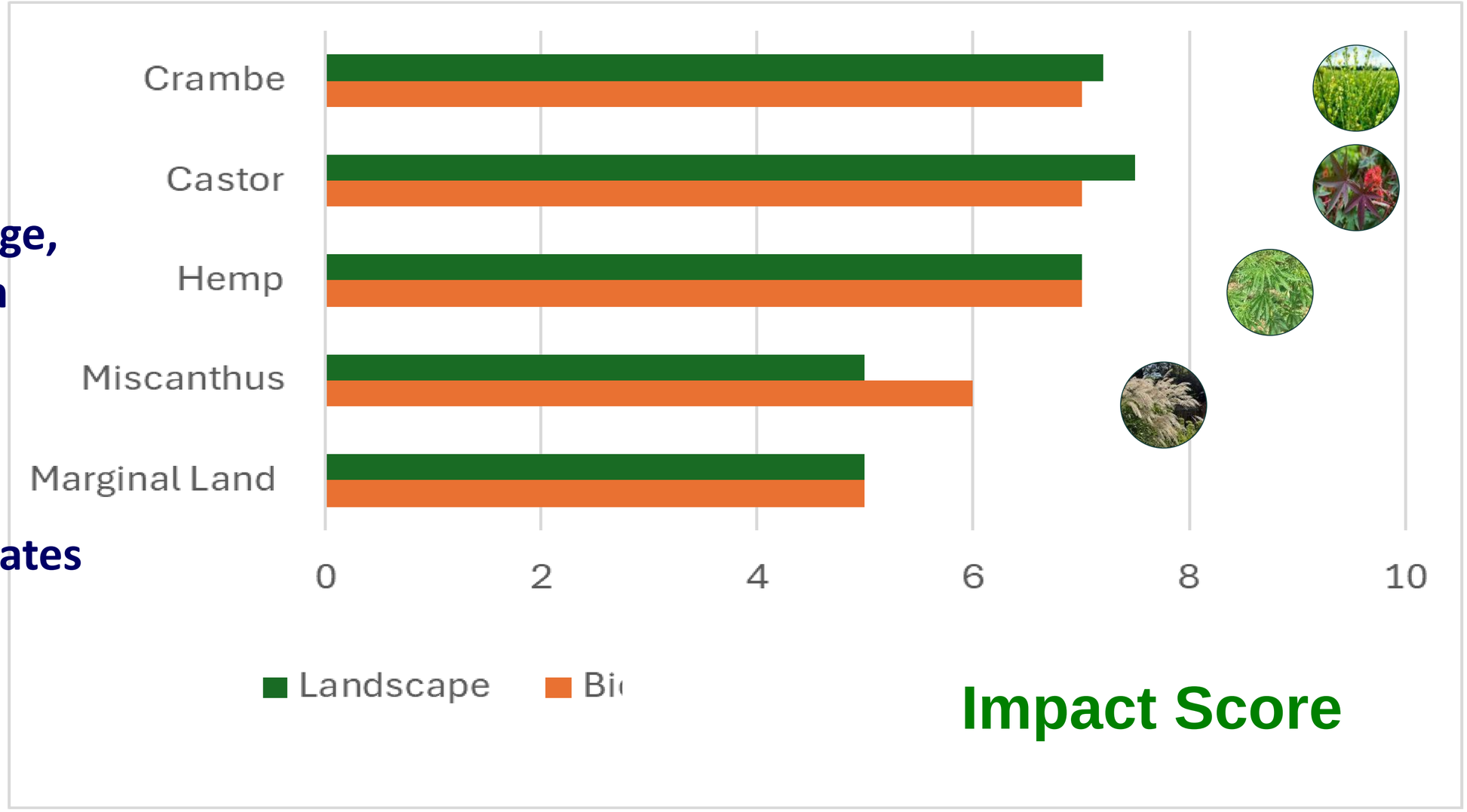


Biodiversity& Landscape

⇨ all crops, monoculture, infringement to biodiversity

⇨ reduced soil tillage, agrochemicals, high biomass

⇨ favors soil microfauna, gives shelter to invertebrates and birds

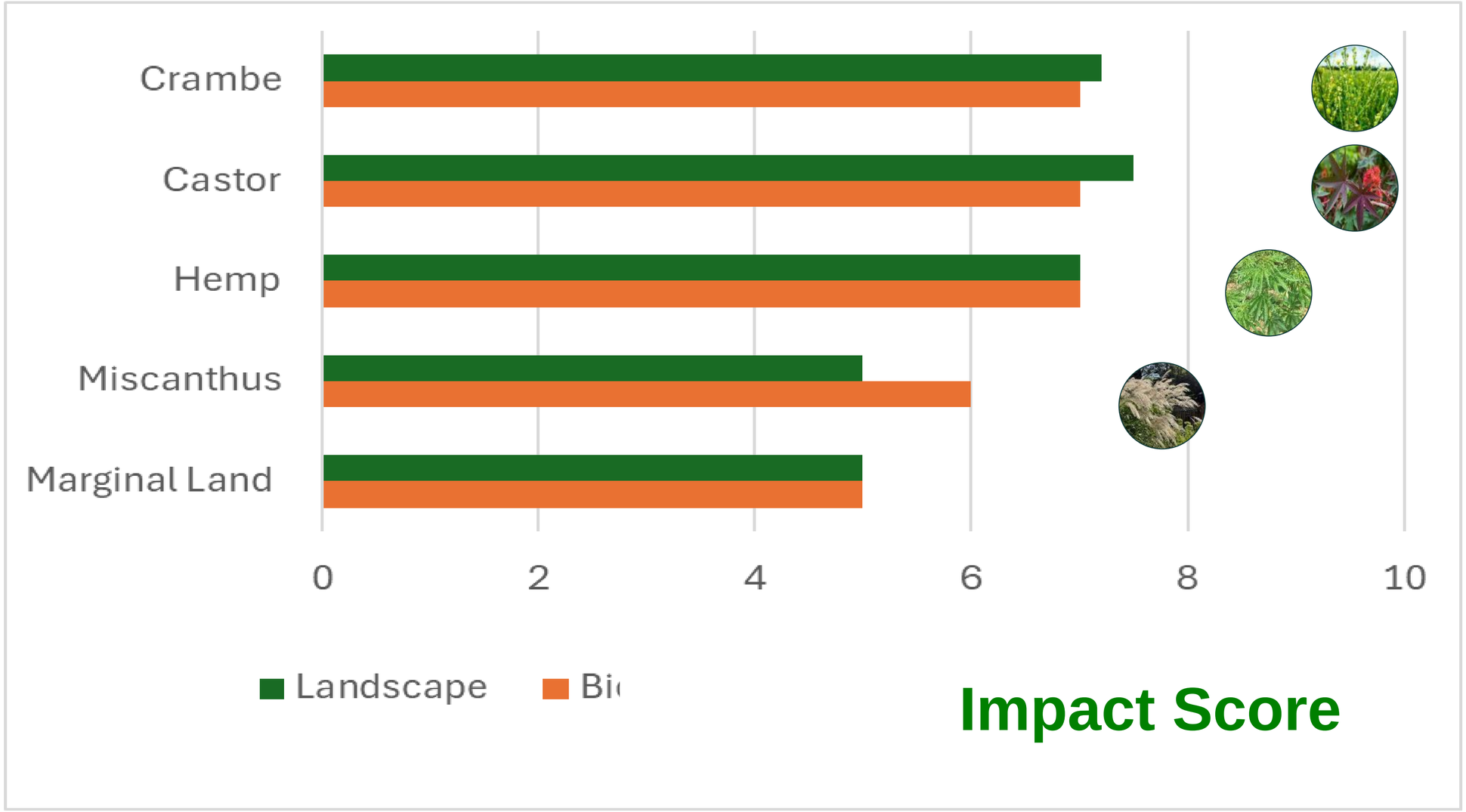


Biodiversity& Landscape

⇨Blossoming give benefits

⇨Structure

⇨Color



Conclusions

⇨ **Growing these crops in marginal soils provide benefits regarding soil properties and erodibility**

⇨ **Miscanthus and industrial hemp showed benefits related with the biological and landscape diversity,**

⇨ **due to the higher density of the biomass, that provides higher coverage to wildlife,**

⇨ **but the oil crops also show benefits due to blossoming**

Conclusions

⇨ **Impacts associated with**

⇨ **water resources and N-fertilizer related emissions were higher in the oil crops and industrial hemp**

⇨ **impacts associated with pesticide related emissions**

⇨ **were low to all the crops studied**

Conclusions

⇨The use of appropriate management practices

⇨adequacy between crop and location,

⇨fertilizers balanced application

⇨innovative farming systems

⇨ intercropping, agroforestry

⇨ established on marginal land at farm level may reward biological diversity index and the impact on the soil quality index

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Thank you

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